

HIGH-FREQUENCY SURFACE ACOUSTIC WAVE DEVICE FABRICATED BY USING AlN-UNCD THIN FILMS

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Keywords: SAW, UNCD, AlN

Abstract

Surface acoustic wave (SAW) devices are important in microwave frequency communication applications due to their high degree of frequency selectivity with low insertion loss and compact in size. Operation frequency of a SAW device contains is determined by the wave length of the acoustic wave of the piezoelectric material, which in turn, is determined by the interspacing of the interdigital transducers (IDT) electrodes. Therefore, for the purpose of increasing operating frequency for the SAW devices, substrate materials having large acoustic wave velocities, such as diamond or SiC are required. However, conventional diamond films usually possess facet granular structure with large roughness, which requires large amount of polishing. Such a process is very time consuming. A diamond films, which have smooth surface is urgently needed for the development of high frequency SAW devices. Ultra-nano-crystalline diamond (UNCD) films possessing smooth surface are good candidate for high frequency SAW application. In this study, we demonstrate a SAW device using AlN/UNCD/Si as material system. UNCD films were grown in a 2.45 GHz microwave plasma enhanced chemical vapor deposition (MPECVD) system on Si (100) substrates in methane and argon (CH_4/Ar) plasma. C-axis oriented Aluminum nitride (AlN) with a thickness of 3 μm were prepared by reactive RF-sputtering technique. AlN with (002) preferred orientation were successfully obtained on UNCD films. A SAW device with good performance will be presented.. Using Network Analyzer (H.P. 8722ES) and GSG probe we can measure the acoustic properties of AlN/UNCD/Si SAW devices.

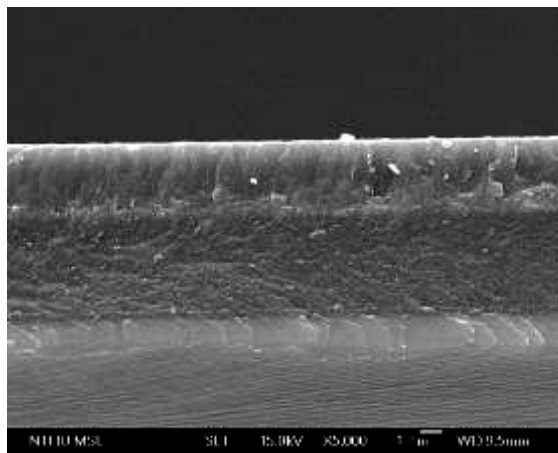


Figure 1. Cross-section SEM surface morphology of AlN/UNCD/Si structure .

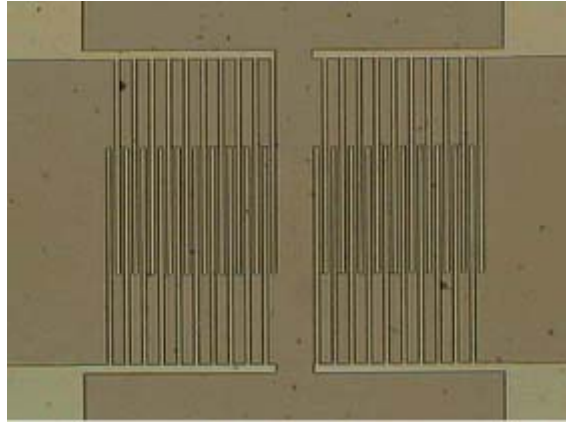


Figure 2. *Optical Image of AlN/UNCD/Si SAW devices.*

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